

Application No.: 10/574,863

REMARKS

Claims 33, 34 and 38 stand rejected under 35 U.S.C. § 112, second paragraph. It is respectfully submitted that the enclosed amendment obviates the alleged indefiniteness. Accordingly, it is respectfully requested that this rejection be withdrawn.

Claim 31 is independent and stands rejected under 35 U.S.C. § 102 as being anticipated by Maydan et al. '612 ("Maydan"). This rejection is respectfully traversed for the following reasons.

Claim 31 recites in pertinent part, "*forming an amorphous layer at a shallow region in a silicon substrate by irradiating a plasma containing He*; and introducing boron by applying a plasma to the shallow region of the silicon substrate; and applying light having an intensity peak at a wavelength of 375nm or longer on the silicon substrate so that said shallow region is excited selectively and the shallow junction is formed electrically activated with the boron" (emphasis added). The Examiner admits that Maydan does not disclose forming an amorphous layer using a plasma specifically containing He (*see* page 3 of outstanding Office Action). Rather, Maydan discloses only a co-implantation with boron. Indeed, as noted in paragraph 265, Maydan is silent as to the particular means by which an amorphous layer is formed, and in fact Maydan expressly discloses a re-crystallization via an anneal process.

According to one aspect of the present invention, the claimed combination of forming an amorphous layer at a shallow region in a silicon substrate by irradiating a plasma *containing He* and applying light having an intensity peak at a wavelength of *375nm or longer* can make it possible to significantly improve light absorptance of the Si substrate surface (*see Figure 3 of Applicants' drawings and the corresponding description thereof on page 19+ of Applicants' specification*).

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Only Applicants have recognized and considered the aforementioned effects, and conceived of the novel and non-obvious combination which can make it possible to realize said effects. Specifically, Applicants found that the light absorption coefficient, reflectivity, absorptance of light and the thickness of a doped layer can be adjusted by *changing a plasma condition* through experiments of repeating the creation of samples in which boron is introduced in a Si substrate with changed conditions of plasma doping and evaluation of the optical property of each of the sample surfaces using an ellipsometer. Further, Applicants also theoretically found that the plasma condition and light to be applied to electrically activate the boron can be appropriately combined so that the sample effectively absorbs the light to electrically activate the impurities introduced at a high rate, the layer containing the boron is selectively excited to preferably activate the boron within the layer, and the impurities are prevented from being diffused at a deep position of the Si substrate (see, e.g., page 5 of Applicants' specification).

By performing such an analysis, Applicants were able to determine parameters which can make it possible to realize significantly improved light absorptance of the Si substrate surface. The cited prior art is silent as to the aforementioned parameters by which such effects can be realized. In this regard, for example, only Applicants recognized and considered that the high coefficient of diffusion for He can make it possible to reduce the amount of He remaining in the substrate post-annealing, whereas elements other than He would remain in the crystal (see, e.g., paragraph 265 of Maydan). In addition, He is a relatively light atom by which amorphous layers can be formed without cutting the surface of single crystals. On the other hand, conventional elements such as Ar, Si, Ge, etc., having a large atomic radius would cut the surface thereby deteriorating device characteristics.

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As noted above, none of the cited prior art discloses forming an amorphous layer at a shallow region *in a silicon substrate* by irradiating a plasma containing He, much less suggest doing so in combination with applying light having an intensity peak at a wavelength of 375nm or longer (combination of which can effect superior results as depicted in Figure 3 of Applicants' drawings and the corresponding description thereof on page 19+ of Applicants' specification). In this regard, Yang '699 does not obviate the aforementioned deficiencies of Maydan. That is, Yang '699 discloses only that a *polysilicon* gate electrode, rather than a silicon substrate, includes He. Moreover, the He is merely doped into a previously-formed amorphous layer, rather than the application of He itself forming the amorphous layer.

As anticipation under 35 U.S.C. § 102 requires that each and every element of the claim be disclosed, either expressly or inherently (noting that "inherency may not be established by probabilities or possibilities", *Scaltech Inc. v. Retec/Tetra*, 178 F.3d 1378 (Fed. Cir. 1999)), in a single prior art reference, *Akzo N.V. v. U.S. Int'l Trade Commission*, 808 F.2d 1471 (Fed. Cir. 1986), based on the forgoing, it is submitted that the cited prior art does not anticipate claim 31, nor any claim dependent thereon. "All words in a claim must be considered in judging the patentability of that claim against the prior art." *In re Wilson*, 165 USPQ 494, 496 (CCPA 1970).

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as claim 31 is patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also patentable. In addition, it is respectfully submitted that the dependent claims are patentable based on their own merits by adding novel and non-obvious features to the combination.

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Based on the foregoing, it is respectfully submitted that all pending claims are patentable over the cited prior art. Accordingly, it is respectfully requested that the rejections under 35 U.S.C. § 102/103 be withdrawn.

CONCLUSION

Having fully responded to all matters raised in the Office Action, Applicants submit that all claims are in condition for allowance, an indication for which is respectfully solicited. If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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